

PATENT APPLICATION  
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**INTRUSION DETECTION RADIO APPLIANCE**

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# INTRUSION DETECTION RADIO APPLIANCE

## CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of pending provisional application serial  
5 number 60/266,504 filed on February 6, 2001.

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention:

10 This invention relates generally to detection systems, and more particularly, to a remote intrusion detection radio appliance device for use by law enforcement and other security personnel.

### 2. Description of Related Art:

15 Numerous types of security systems are known: examples of such a system are disclosed in U.S. Patent No. 5,657,076, which uses an unspecified detector to monitor one or more areas, and if triggered, to switch a video signal onto a TV set. A further security system is disclosed in U.S. Patent No. 5,638,046, which uses a passive infrared motion sensor connected to an RF transmitter which sends encoded data to a remote receiver. The use of encoded data precludes the use of certain radios, such as FRS, and the system is  
20 restricted by FCC licensing and/or range limitations.

Another known system is disclosed in U.S. Patent No. 5,572,201, which uses a transmitter to broadcast emergency information in the FM band, temporarily overriding radio signals received by the public.

25 A still further alert system is disclosed in U.S. Patent No. 5,546,072, which uses multiple radio transmitters and multiple unspecified sensors to provide security for a large area. Data is transmitted on an RF carrier, and a direction finding technique is employed to determine which location is affected. This is a far more ambitious and costly system than the system of the present invention and not readily used by law enforcement or security personnel.

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Other known systems are shown in U.S. Patent Nos. 5,534,851, 5,440,292, 5,019,802, 4,949,075, 4,511,887 and 4,121,200.

While the foregoing described prior art provides some improvement in the security system area, there remains the need in the art for an easy-to-use and less costly device for use by law enforcement and other security personnel to detect intruders, at a reasonable price.

### **SUMMARY OF THE INVENTION**

Accordingly, it is a general object of the present invention to provide an improved intrusion detection radio appliance. It is a particular object of the present invention to provide an improved remote intrusion detection radio appliance. It is a still more particular object of the present invention to provide an improved remote intrusion detection radio appliance using one or more passive infrared motion detectors. It is yet a more particular object of the present invention to provide an improved remote intrusion detection radio appliance for use by law enforcement and other security personnel. It is a still further particular object of the present invention to provide an improved remote intrusion detection radio appliance that may be conveniently mounted on a flat surface or secured to a wall or other flat surface. And, it is yet a still further object of the present invention to provide an improved remote intrusion detection radio appliance that provides intrusion monitoring and remote detection, in a low-cost manner, and which can broadcast an audio or video signal through a separate broadcast unit, such as a radio or cell phone, and then monitor an area for the presence of an intruder.

In accordance with one aspect of the present invention, there is provided a remote unit that may be supported on a flat surface and which has a securable backing means for securing to a flat surface. The remote unit has a passive infrared motion detector, which, upon sensing motion, broadcasts a signal over a separate radio unit or cell phone plugged into a socket in the remote unit for reception by law enforcement or other security personnel.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The objects and features of the present invention, which are believed to be novel, are set forth with particularity in the appended claims. The present invention, both as to organization and manner of operation, together with further  
5 objects and advantages, may best be understood by reference to the following description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view of a preferred embodiment of the intrusion detection unit of the present invention; and

FIG. 2 is a front elevational view of the intrusion detection unit of FIG. 1;

FIG. 3 is a cross-sectional view, taken along line 3 - 3 of FIG. 2;

FIG. 4 is a top elevational view of FIG. 2; and

FIGS. 5 - 7 are schematic representations of the preferred internal circuitry used in the unit of FIG. 1.

## **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

The following description is provided to enable any person skilled in the art to be able to use the invention and sets forth the best modes contemplated by the inventors for carry out their invention. Various modifications, however, will remain readily apparent to those skilled in the art, since the generic principals of  
20 the present invention have been defined herein, specifically to provide for an improved intrusion detection unit 10.

*low cost*  
The intrusion detection unit 10 of the present invention may use any desired components, with the elements thereof made from any desired material.

*sub. a1*  
25 As best shown in FIGS. 1- 4, the unit 10 of the present invention includes a body or housing 12 having all necessary components held therein. The body or housing 12 includes sides, a base, a front 14, a back 16 and a passive motion detector 18 connected to a power source 20, such as a battery, via a circuit board 22.

30 As shown in FIG. 3, the rear housing 16 includes a securing means 24, such as a hook and loop fastening means or magnetic holding strip, to allow the

unit 10 to be secured in a desired location. For example, the unit 10 can be supported on its base on a flat surface, or secured against a wall, a desk, a filing cabinet, or other flat surface, in an area or room that is to be monitored, such as one that has been checked by law enforcement or other security personnel. The unit 10 would then be turned on and a separate radio unit or cellular telephone plugged into a port in the housing 12, to detect the presence of an intruder after the law enforcement or other security personnel has left the area or room. The unit 10 or the cellular telephone and/or radio unit plugged into the device may include the necessary video or audio adapters and related software, well known to those skilled in the art, to take and transmit images and/or sounds of an intruder. Any camera associated with the cellular unit 10, the telephone or the radio unit may be of the normal still or video type. This unit 10, therefore, allows more law enforcement or other security personnel to be freed for searching, or other duties, and eliminates the need for them to remain in an area or room that is to be monitored, such as one that has already been inspected or searched, or that is to be continuously monitored. That is, the unit 10 of the present invention will detect the presence of a human intruder, trigger the transmitter of an external radio unit or cell phone plugged into the unit, broadcast a stored audio message in the unit, and then pickup and broadcast still or video images and/or ambient sound from the area or room where the unit is located. To save battery life in the unit and/or the external radio, the unit will include a means to automatically switch power on and off and to switch off power when not in use in or connected to a microcontroller 36 to turn the external radio or cell phone to standby, if no intruder is present.

25 *sub. a2* The passive infrared motion detector 18 preferably uses a dual element pyroelectric sensor 20, which measures changes in heat within its field of view. A fresnel lens 26, having a wide angle of view, is preferably used to divide the field of view into multiple zones whereby an object, moving from one zone to another, suddenly appears or disappears from the sensor's view. The moving  
30 object, therefore, causes a change in signal levels, which is sensed by the accompanying circuitry in the motion detector.

As set forth above, the goal of the unit 10 of the present invention is to be easily portable and to provide area intrusion monitoring and remote detection at low cost for use by law enforcement and other security personnel. This is provided by the unit 10 of the present invention, in which a microcontroller and its' firmware operation and circuitry on the board 22 control the implementation of this intrusion detection radio appliance.

As shown in FIGS. 5 - 7, the detector 18 is preferably a dual-element pyroelectric passive infrared detector that, like all pyroelectric detectors, is sensitive only to changes in temperature. A change in temperature produces a small voltage, which is amplified by an internal JFET transistor. The detector's dual elements are connected opposing one another. This helps reduce false triggering due to changes in ambient temperature. Any such thermal changes will affect equally both elements and will cancel, producing no output.

The detector 18 is positioned at the focal point of the fresnel lens 26. The lens 26 is designed to have a wide field of view to cover as much of the surrounding area as possible. The lens 26 is also designed with multiple zones, which pass or block infrared energy from an object depending upon position. As a warm object, such as a person moves through the field of view, the zones of the lens 26 breaks repeatedly as the person moves across the field of view. This chopping affect creates a change in infrared temperature of the detector 18, thereby producing an output signal.

A two-stage bandpass filter 28 and amplifier 30 are used and shown in FIG. 5. The amplifier 30 is sensitive to frequencies between 1 and 25 Hz only. This further helps reduce false alarms since normal human motion will fall within this range. The total gain of the amplifier chain is 76dB. This high gain is needed because the amount of infrared energy striking the detector 18 is very low and thus the signal from the detector is very low as well.

A dual-threshold window comparator is formed by 32 and 34, as shown in FIG. 5. The output of the amplifier 30 is compared with voltage levels set by R8, R9 and R10. If the signal rises above the lower threshold, TRIGA! will switch from a logic high to a logic low. If the signal drops below a lower threshold,

TRIGB! will similarly switch. The circuit is designed such that the system will trigger when infrared energy from an object passing from a light to a dark zone, or from dark to light, is sensed.

As shown in FIG. 6, an 8 bit microcontroller or microprocessor 36 with on-board program ROM and RAM is preferably used. The microcontroller 36 operates at a low frequency set by a crystal X1. This low frequency keeps power consumption low for prolonged battery life. Also, as described above, the microcontroller 36 includes a means to prolong battery life in the external radio or cell phone, by turning the external radio or cell phone to standby, if no intruder is present.

An LED 38 is driven by one output port from microcontroller 36. Upon power up, this LED 38 will flash for a predetermined time, such as several tens of seconds. During this time, the amplifier and detector circuit are allowed to stabilize, and triggers are inhibited. This allows an operator to turn the unit on, plug in a separate radio unit or cell phone, if not already done, and leave the area without triggering the system. Once the LED 38 stops flashing, the system is armed and ready to sense movement and broadcast on the external radio or cell phone plugged into the unit 10.

The TRIGA and TRIGB signals from the window comparator 32, 34, previously discussed, are inputs to the microcontroller 36. Either of these inputs becoming a logic low will start the transmit cycle. The cycle begins by microcontroller 36 turning on power to the output circuitry. This signal is called, or indicated as, +5VSW, and by keeping this off except when triggered, helps extend battery life.

When the XMT! signal is brought low, a load is applied to an external microphone input 39 to the external radio or cell phone, which simulates keying the push to talk switch. The external radio or cell phone will now transmit the stored audio and then ambient audio or video images.

The ALARM output from microcontroller 36 produces a modulated square wave that is coupled into a transmit output amplifier 40 by R26 and C23 (see  
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FIG. 7). Unless somehow shutoff, this causes a beeping tone which precedes the transmission of the stored audio message.

sub. a3  
5 As shown in FIG. 6, the unit 10 includes an analog record/playback device 42 having a flash memory as a non-volatile storage medium. This device 42 may store up to 12 seconds of audio. When a trigger occurs and the external radio or cell phone has been placed into transmit mode, a PLAY signal is brought low causing a playback of the recorded audio signal. Device 42 is designed to directly drive a speaker 44 so the signal is coupled to amplifier 46 by R28 and C26. The output of amplifier 46 is then fed to output amplifier 40.

sub. a4  
10 Once the transmission of the previously recorded audio is completed by the device 42, the signal from a microphone 48<sup>39</sup> is amplified by amplifier 50. The output from this amplifier 50 is also coupled into output amplifier 40 so that ambient sounds may be monitored and transmitted for several seconds, or the plugged in cellular telephone and any video camera may transmit images to alert law enforcement or other security personnel of an intruder.

20 To record on the device 42, a record button is pressed and held. The microcontroller 36 then powers up the microphone circuitry and sends a record command to the record/playback device 42. While recording, the LED 38 turns on. Recording stops when the user releases the button or when a maximum time of approximately 12 seconds has elapsed.

sub. a5  
25 Power to the unit 10 is turned on and off with a momentary pushbutton 50 (see FIG. 7). A CMOS flip-flop 52 is powered whenever a 9-volt battery 54 is connected thereto. The current draw by 52 is low enough that the shelf life of the battery 54 is not significantly affected. Each time the power button 50 is pressed, flip flop 52 toggles between the set and reset conditions. In the reset condition, 56 is turned on, thus sending power from the battery 54 to voltage regulator 58, and hence powering up the rest of the circuitry. In the set condition, 56, and all other circuitry, are off.

30 It, therefore, can be seen that the present invention provides a novel and improved, low cost intrusion detection device into which a separate radio or cellular telephone unit is plugged to allow law enforcement or other security

personnel to leave the intrusion detection unit in a given area for monitoring the area, without the need for further personnel.

Those skilled in the art will appreciate that various adaptations and modifications of the just-described, preferred embodiments can be configured without departing from the scope and spirit of the invention. Therefore, it is to be understood that, within the scope of the appended claims, the invention may be practiced other than as specifically described herein.

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